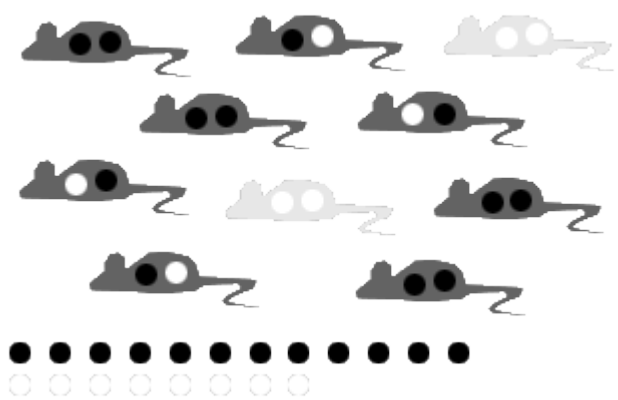
Population Genetics Introduction

*A **gene pool** is the genetic make-up of a specific population, and is the combination of all the alleles for all traits members of the population exhibit.* For example, in a population of mice, the gene pool consists of all the alleles of the genes for each individual mouse.



In the gene pool beside, 60% of the alleles are black (B) and 40% are white (b). *The percent of alleles in a pool is known as an **allele frequency***. The sum of all alleles in any pool must be 100%.

*The **Hardy-Weinberg principle** (sometimes called the Castle-Hardy-Weinberg principle; it was named after the scientists who discovered it) states that the allele frequency for dominant and recessive alleles remains the same over the generations in any given population so long as certain conditions exist*. In other words, 60% of the alleles in the sample population above will always be for black coats and 40% of the alleles will always code for white coats, even 100 years from now, so long as nothing happens to the population. These five conditions must be met in order for the principle to work:

1. No mutations can occur.
2. The population must be large.
3. All mating must be random (any male can mate with any female or vice versa).
4. No migration can occur.
5. All genotypes must be equal.

The Hardy-Weinberg principle is based on mathematical laws of probability, and similar to Punnett Squares, the results can be charted on a graph called a cross-multiplication table. When two alleles are randomly drawn from the gene pool (representing random mating), the resulting probability is the product of the two individual probabilities for drawing each allele. Hence, the probability of producing a Bb child is:
B x b = Bb
60% x 40% = 24%
The probability of producing a BB child is:
B x B = BB
60% x 60% = 36%
On a cross multiplication table, the results look like this:

	**B .60**	**b .40**
B .60	**BB .36**	**Bb .24**
b .40	**Bb .24**	**bb .16**

Because a Bb mouse will still produce a black coated mouse, the percentages can be added to find that 84% of the mice in the population will be black (36% + 24% +24%) and 16% will be white. As long as the required conditions are met, this population will always be 84% black and 16% white.